DOE/RA/50404-1232
App B-Vol I

DOE/RA/50404--1232-App.B-Vol.1

DE83 001051

FINAL TECHNICAL REPORT

COOPERATIVE AGREEMENT NO. DE-F-CO2-81RA50404
BETWEEN
WYCOALGAS, INC. AND U.S. DEPARTMENT OF ENERGY

Period of Performance
NOVEMBER 1980 - MAY 1982

DOE/RA/50404--1232-App.B-Vol.1

MASTER

A Subsidiary of
PANHANDLE EASTERN CORPORATION

WyCoalGas, Inc.

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APPENDIX B
PRELIMINARY TECHNICAL DATA REPORT
WYCOALGAS PROJECT WATER SYSTEM
VOLUME I

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January 14, 1981

Mr. J. M. Coleman
Panhandle Eastern Pipe Line
Post Office Box 1642
Houston, Texas 77001

Dear Mr. Coleman:

We are submitting three (3) copies of the report entitled "Preliminary Technical Data Report, WyCoalGas Project Water System". This report is in response to your verbal request at our meeting on January 8, 1981.

This report details the water sources that would be available to WyCoalGas for their proposed gasification plant north of Douglas, Wyoming. It also describes the various features of the water supply system which includes Panhandle Reservoir #1 (Combs), LaPrele Dam and Reservoir, Pumping Plants, Pipelines, and Wells. The report also discusses the Operations Study which delineates the water requirements from the various sources based upon the coal gasification plant requirements. The water quantities are based upon the water historically available from these sources for the years 1930-1979. Estimates of manpower, construction costs, and time requirements are also included in this report.

The following results are based upon information available to us at this time. The numbers will change as the project evolves, and it should be understood that the report as currently presented is based on preliminary data. The results are summarized in the following tabulations:

Water Sources	Quantities in Acre-feet per Year Average	Minimum	Maximum
LaPrele Reservoir	4,410	2,410	5,000
North Platte 1974 Appropriation	3,600	0	16,540
Groundwaters (required only 5 years out of 50)	*	0	2,680

*Because groundwater is only required 5 years out of 50 years, a long-term average value has no meaning.

Estimated costs to develop the water supply are:

Item	Cost
Pipelines:	
Morton's to Plant Site	$ 1,440,000
Green Valley to Pumping Site	4,350,000
Pumping Station to Reservoir	4,100,000
Pumping Station to Plant Site	6,100,000
Morton's Collection System	2,400,000
Green Valley Collection System	1,160,000
Panhandle Reservoir #1	21,000,000
Roads	5,100,000
Total	$45,650,000

We will continue to evaluate the water supply requirements as more information becomes available and as changes are required. The computer operations model program will be modified to incorporate the LaPrele Reservoir operations into the overall Operations Study. If any points in the report require further clarification, please contact us.

Sincerely,

Banner Associates, Inc.

Floyd A. Bishop

By _____
Floyd A. Bishop

FAB/ssb

PRELIMINARY TECHNICAL DATA REPORT

WYCOALGAS PROJECT WATER SYSTEM

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INTRODUCTION

The WyCoalGas, Inc. proposed coal gasification plant site is approximately 16 miles north of Douglas, Wyoming, located generally in Sections 27 and 34, T35N, R70W of the sixth principal meridian. The location of the plant site is shown on the general location map, Figure A-1. The plant site is located in typical high plateau plains of central Wyoming. Climate in the area is typical of semi-arid central Wyoming and is subject to wide variations in temperature. Precipitation in the area averages about 14 inches per year, of which about 10 inches fall during the April-September irrigation season.

Projected water requirements at the plant site are 6020 acre-feet per year. Since the proposed plant site is not near any major streams or rivers, water must be transported to it. Water will be supplied from four sources -- two surface water and two groundwater.

The two surface water sources are LaPrele Reservoir and flood flows from the North Platte River with a 1974 appropriations date. LaPrele Reservoir is located approximately 14 miles west of Douglas, Wyoming, and is shown on Figure A-1.

Water will be released from LaPrele Reservoir and flow down LaPrele Creek to the North Platte River. Water from the North Platte River will be diverted at a point in Section 7 of T33N, R71W. The LaPrele water and excess water from the North Platte will be pumped from the river and stored in Panhandle Reservoir No. 1, which is also referred to as Combs Reservoir. The general location of these features relative to the plant site is shown on Figure A-1. A pipeline will convey water from Panhandle Reservoir No. 1 to the coal gasification plant site.

The two groundwater sources are located north of Douglas and west of Douglas. The north site is referred to as the Morton's Well Field, and the west site

is referred to as the Green Valley Well Field. Both sites are shown on Figure A-1. Water will be pumped into a collection system and then piped from central locations to the plant site from the Morton's and Green Valley Well Fields.

The water from the Green Valley Well Field will be transported through a pipeline to the pumping plant near Panhandle Reservoir No. 1. The pumping plant will boost the water to the coal gasification plant site.

Whenever possible, the sequence of using the water sources will be as follows. LaPrele water will be used first to its maximum of 5,000 acre-feet per year, when available. The 1974 right will be used secondly, when available. Water from the Green Valley Area will be used up to 2,000 acre-feet per year, followed by pumping the Morton's groundwater in the Lance-Fox Hills Formation for another 2,000 acre-feet, if required.

CHAPTER I

SURFACE WATER SUPPLY

A total water demand of 6,020 acre-feet per year is anticipated for the WyCoalGas coal gasification plant. The sources of water proposed to meet this demand are:

1. LaPrele Reservoir
2. 1974 Direct Flow Right from the North Platte River
3. Groundwater - Morton's and Green Valley Area

In connection with the use of these water sources, Panhandle (Combs) Reservoir No. 1 would be constructed.

A computer operation study (Panhandle Eastern Water Supply Operation Study) was utilized to model the combined use of these water sources and the Panhandle Reservoir No. 1. A description of each of the surface water sources and their anticipated yield follows.

LaPrele Reservoir

LaPrele Reservoir is located in Section 21, T32N, R73W, and operates under the two permits listed below:

Permit	Priority	Storage Right
728R	September 21, 1905	15,106 acre-feet
1581R	July 7, 1909	4,894 acre-feet

Use of LaPrele waters by Panhandle Eastern results from an agreement reached between Panhandle Eastern and the Douglas Reservoirs Water Users Association. Panhandle Eastern contracted for up to 5,000 acre-feet of water per year in exchange for financing the rehabilitation of LaPrele Dam. The basics of the agreement and further regulations placed on the agreement by the State Board of Control Order #20 are as follows:

1. No water rights on LaPrele Creek shall be injured.

2. Panhandle Eastern can receive up to 2,500 acre-feet on a reasonably uniform basis during the nonirrigation season (October 1 to April 30).

3. During the irrigation season (May 1 to September 30), Panhandle Eastern can receive up to the difference between actual deliveries during the immediately preceding nonirrigation season and 5,000 acre-feet, delivered on a reasonably uniform basis.

4. During the irrigation season, if insufficient water is impounded to supply both the irrigation needs and Panhandle's contract, the available water shall be apportioned 75% to irrigation needs and 25% to Panhandle Eastern.

5. Any dam leakage shall be accounted for as storage water and charged and delivered to Panhandle Eastern as a portion of their 5,000 acre-foot entitlement.

6. The reservoir shall be operated under the one-fill criteria with all releases to Panhandle Eastern deducted from the annual entitlement of water for LaPrele Reservoir.

7. Conveyance losses from LaPrele Dam to Panhandle Eastern's point of diversion shall be considered.

Based on the above criteria, a separate operation study of LaPrele Reservoir was conducted. The period modeled was 1930-1979. A detailed description of the LaPrele Operation Study and the assumptions used can be found on page 18 of this report. The result of the LaPrele Operation Study showed that, on the average, a volume of 4,610 acre-feet of water per year would be available below the LaPrele Dam for Panhandle Eastern. The lowest amount of water available for Panhandle Eastern in any one year was 2,400 acre-feet. A conveyance loss of 10% was assumed from LaPrele Dam to Panhandle Eastern's point of diversion. This involves a distance of approximately 20 miles along LaPrele Creek

and 4.3 miles along the North Platte River. A program has been initiated to gage LaPrele Creek to determine actual conveyance losses. Loss figures will be adjusted as determined by the program and analysis of information or as determined by the State Engineer's Office. In almost every year little or no water was available to Panhandle Eastern in the months of August and September. A graph of the LaPrele Reservoir end-of-month storage that resulted from the operation study is shown in Figure C-2. Shortages to the irrigators and Panhandle Eastern occurred as early as June several times in the operation study. Shortages to the irrigators would occur almost every year in the late irrigation season even without Panhandle Eastern's involvement. This is due to the large amounts of lands served by a relatively small reservoir. Historically, this has been shown to be the case. The most consistent yield to Panhandle Eastern occurs during the nonirrigation season when the average effective yield would be the full nonirrigation season apportionment of 2,500 acre-feet. A graph of the yearly LaPrele supply released to Panhandle is shown in Figure C-1.

1974 Direct Flow Right from the North Platte River

Panhandle Eastern obtained a direct flow right from the North Platte River with a priority date of 1974. In conjunction with this, a storage right for the North Platte water in Panhandle Reservoir No. 1 was obtained. The point of diversion on the North Platte would be in Section 7, T33N, R71W. Panhandle Eastern would be able to obtain water from the North Platte, when in priority, at a maximum rate of 201.2 cfs, not to exceed 26,539 acre-feet for storage in any year.

The occurrence of North Platte water availability used in the Panhandle Eastern Water Supply Operation Study was based on the North Platte River Operational Study developed by WRRI (Water Resources Research Institute). This model simulates the North Platte River System, accounting for all gains, storage rights, and power operation needs for the large government reservoirs, irrigation re-

quirements, river losses, and interstate compacts with Nebraska. The model was first developed in June of 1977, and has since been revised and updated. Agencies participating in and reviewing the revised model are the State Engineer's Office and the Water and Power Resources Service. From this operation study, the gain in the North Platte River System which is above all demands and interstate agreements (referred to as "Owed To the River" water) would be available under Panhandle Eastern's 1974 priority. For the Panhandle Eastern Water Supply Operation Study it was assumed that there must be more than 6,000 acre-feet of "Owed To the River" (O.T.R.) water available in any month before any water becomes available to Panhandle Eastern. This provides an administrative water "cushion" to assure that no adverse effects would result to prior rights on the North Platte River. All O.T.R. water in excess of 6,000 acre-feet per month but limited to Panhandle's right of 201.2 cfs (approximately 12,000 acre-feet per month) was made available to Panhandle Eastern. In many cases, water that was available to Panhandle Eastern was bypassed due to the lack of storage space in Panhandle Reservoir #1. The 50-year average of O.T.R. water for the period of 1930-1979, obtained from the North Platte River Operational Study, was 124,300 acre-feet per year. As a result of the Panhandle Eastern Water Supply Operation Study, the average availability of the O.T.R. water to Panhandle Eastern was 11,500 acre-feet per year. The operation study indicates that Panhandle Eastern would have been able to divert, on the average, only 3,600 acre-feet per year of water available to them. The maximum amount diverted in one year was 16,500 acre-feet with a minimum of zero. The amount that would have been diverted by Panhandle Eastern during the study period of 1930-1979 would be less than 3% of the total O.T.R. water in the North Platte River. The North Platte water is not available to Panhandle Eastern every year and is typically available only in the months of April through June. During the period of 1954-1967, Panhandle Eastern would have had North Platte water available to them only during 3 months

and in quantities insufficient to completely fill Panhandle Reservoir #1. The volume of O.T.R. water is usually large when it does occur; for example, 758,400 acre-feet was available in one month. A graphic comparison of total O.T.R. water, water available to Panhandle Eastern, and water used by Panhandle is shown in Figure C-3.

Panhandle Reservoir No. 1 lies on Soldier Creek drainage and would be entitled to flows from Soldier Creek. No records of flows for Soldier Creek are available. Similar drainages show a great variation in the amount of flow available from year to year ranging from 2 acre-feet to over 2,000 acre-feet. It was felt that flows from Soldier Creek would not be a reliable source of water. Therefore, to remain conservative relative to the overall water supply, Soldier Creek flows were not included as a water source. A graph of the Panhandle Reservoir No. 1 end-of-month storage that results from the operation study is shown in Figure C-4.

CHAPTER II

GROUNDWATER SUPPLY

Two well fields were located relative to the development of supplemental groundwater supplies for the proposed coal gasification facilities. The first of these well fields is referred to as Green Valley and is located approximately 12 miles west of Douglas in the foothills of the Laramie Range (see vicinity map, Figure A-1). The Madison and Flathead are the principal geologic formations of interest for aquifers in the Green Valley Area. A test well (Green Valley No. 1 Well) was drilled in early 1974 in this area. A brief description of the drilling and testing program is contained herein. The data obtained during the drilling and testing program are contained in the August 1980, Banner Associates, Inc. report entitled Summary of Panhandle Eastern Pipe Line Company's Groundwater Investigations near Douglas, Wyoming.

The second well field is referred to as the Morton's Well Field and is located north of Douglas about 10 miles. The aquifer of primary interest in this area is comprised of the Lance and Fox Hills formations. A drilling and testing program was conducted on the Lance-Fox Hills aquifer in late 1974 and early 1975. A brief description of the drilling and testing program is contained herein. The data obtained during this drilling and testing program are also included in the August 1980 report entitled Summary of Panhandle Eastern Pipe Line Company's Groundwater Investigations near Douglas, Wyoming.

Applications for 9 wells in the Green Valley Area and 19 wells in the Morton's Area were submitted to the State Engineer February 12, 1974, and are currently being held in a pending status.

According to current operation studies being conducted on the Panhandle No. 1 Reservoir, groundwater will be required to make up deficits of surface water five years during the fifty-year simulation period. The groundwater re-

quirements during these years range from 1,050 acre-feet to 2,680 acre-feet per year.

Green Valley Area

Geology

The general area of investigation within the Green Valley Area is underlain by sediments ranging in age from Cambrian through Tertiary. These units overlie an older igneous and metamorphic basement complex of Precambrian age. Most of the formations have dips of 25° to 30° as they plunge northward into the Powder River Basin.

Subsurface information from oil and gas test wells in the area indicates at least four formations are prospective sources of groundwater supplies in the Green Valley Area. The aquifers are, in descending order: the lower Sundance formation; the Canyon Springs sandstone; the Casper (Tensleep) formation; and the Madison formation and Cambrian, Flathead sandstone.

The Madison formation was selected for study due to its widespread nature in the Powder River Basin, and the fact that there are relatively few other appropriators using the Madison formation. The Green Valley Area was selected due to its location in respect to potential plant sites for a coal gasification facility, the accessibility of the area, and the fact that water from the Madison formation is used in oil field flooding operations near Glenrock, Wyoming.

Previous Drilling and Testing

A test well (Green Valley No. 1 Well) was drilled between January 14, 1974, and March 8, 1974, in the SE¼SW¼ Section 32, T33N, R73W. The well was drilled to a total depth of 6,700 feet, and casing was set to a depth of 6,434 feet. Drill stem tests were conducted in the Casper, Madison, and Flathead formations. The results of the drill stem tests, geophysical logs, well sample descriptions, and results of corings are contained in the report Summary of

Panhandle Eastern Pipe Line Company's Groundwater Investigations near Douglas, Wyoming.

Upon completion of the drilling program, the well was pump tested by means of a submersible pump and a diesel powered electric generator. Water levels were measured by means of downhole pressure devices, acoustic well sounders, and direct reading water level indicators. Pumping rates, discharge pressures, and the temperature of the water were monitored throughout the testing program.

Initially, a step test was conducted, and a long-term test started but terminated after 10 days of pumping due to generator problems. The well was then stimulated with an acid fracturing technique. After acidizing, the well was step tested again and showed an increase of about 250% in specific capacity (yield per foot of drawdown). The well was allowed to recover and was then tested for 19 days at an average pumping rate of 414 gallons per minute. More details relative to the pump testing are contained in the summary report.

Calculations show the transmissivity and storage coefficients to be 1,000 to 1,100 gallons/day/foot and 5×10^{-3}, respectively. These values should be considered very preliminary since the pumped well was used for the calculations and there was difficulty during the testing in obtaining reliable water level measurements.

Water Quality

The analyses conducted on water from the Green Valley No. 1 Well indicate that it has high concentrations of calcium, sodium, sulfates, and bicarbonates and is very hard. Due to the high amounts of total dissolved solids (1,052 to 1,974 mg/l) and high sulfate content (520 to 670 mg/l), the water is not potable according to drinking water standards. Details on the water analyses are contained in the summary report.

Current Drilling and Testing

A drilling and testing program is currently being initiated in the vicinity of the Green Valley No. 1 Well. This program involves drilling two observation wells in the near vicinity of the existing Green Valley No. 1 Well and retesting the existing well for an estimated period of 30 days. Drilling is expected to commence by January 20, 1981, and is expected to be completed by April 1, 1981.

Proposed Development

The Green Valley Well Field is expected to consist of approximately 10 to 12 wells with capacities of 300 to 600 gallons per minute each. Due to the close proximity of some of the wells to each other, some of the wells will be used for standby purposes. The reader is referred to Figure B-1 contained in Appendix B of this report for the location of the wells in the well field. Since all of the geological work conducted to date has not been reviewed and the drilling and testing program currently being conducted is not complete, the well locations shown on Figure B-1 must be considered preliminary.

Morton's Area

Geology

The Morton's Area is underlain by the Wasatch, Fort Union, Lance, and Fox Hills formations in descending order. The Wasatch, Fort Union, and Lance formations are all several hundred feet thick while the Fox Hills formation is only 110 to 140 feet thick in the Morton's Area. The area of interest lies on the east flank of the Powder River Basin very near its axis. Shallow, 1° to 2° dips of the formations in this area are normal.

Of primary interest during this phase of investigation were the Lance and Fox Hills formations. The Lance formation (Upper Cretaceous) consists of alternating very fine to fine-grained gray sandstones, and gray, carbonaceous shales. The Fox Hills formation (Upper Cretaceous) consists of fine to medium-

grained, light gray, slightly calcareous sandstone. Both formations are used as sources of water for oil and gas field flooding, municipal, and miscellaneous uses within the Powder River Basin, but not in the vicinity of the study area.

Previous Drilling and Testing

A test well (Morton's No. 1-23 Well) was drilled in the Morton's Area in November 1974. The Morton's No. 1-23 Well was drilled to a depth of 6,330 feet, and the interval from 4,227 feet to 6,330 feet was screened.

Samples were collected from a depth of 2,000 feet to 6,330 feet, and geophysical logs were run in the well to a depth of 6,300 feet. Sample descriptions and geophysical logs are contained in the summary report.

After the well was completed, it was tested for a period of 15 days in January 1975, but the test had to be terminated due to problems with the pump. Another long-term test was conducted from February 3 to March 6, 1975, with an average pumping rate of 219 gallons per minute. The pumping level at the conclusion of this test was 1,806 feet.

Calculations show the transmissibility of the Lance-Fox Hills Formation is about 500 gal./day/foot and the storage coefficient is about 1×10^{-5}. These values should be considered preliminary since the pumped well was the only well in which data was obtained and by virtue of the fact that only part of the Fox Hills formation was penetrated. Data obtained during the testing of the Morton's No. 1-23 are contained in the summary report.

Water Quality

The analyses conducted on the water from the Morton's No. 1-23 indicate that it is a sodium bicarbonate type and is very soft. Due to the high amounts of total dissolved solids (580 to 700 mg/l) the water is nonpotable by drinking water standards. The sodium content is very near and sometimes surpasses the maximum amount recommended for drinking water. The water quality

analyses conducted on water from the Morton's No. 1-23 are contained in the summary report appended hereto.

Current Drilling and Testing

A drilling and testing program is currently being implemented to drill, construct, and develop two observation wells in the vicinity of the Morton's No. 1-23 Well. Upon completion of these wells, the aquifer will be retested.

Proposed Development

The Morton's well field is anticipated to consist of approximately 20 wells with capacities of 100 to 300 gallons per minute each. The reader is referred to Figure B-2 contained in Appendix B of this report for a more detailed description of the well field. Since the proposed drilling and testing program has not been completed, the well locations shown on Figure B-2 must be considered preliminary.

CHAPTER III

PANHANDLE NO. 1 (COMBS) RESERVOIR

Panhandle Reservoir No. 1 will be located on Soldier Creek north of Douglas, Wyoming (see Figure A-1). The reservoir will have a capacity of 26,540 acre-feet and will provide storage for North Platte River water to be used at the industrial plant.

The major purpose of this reservoir will be to store water from Panhandle Eastern's 1974 North Platte right. The reservoir will also serve to store any excess water delivered from the LaPrele supply.

Water is appropriated for and diverted to the reservoir under the following permits:

Permit	Date	Storage Right or Flow Rate
7613 Res	February 14, 1974	24,190 acre-feet
7614 Res	July 9, 1974	2,349 acre-feet
24403	February 14, 1974	
6523 Enl	March 28, 1974	
6524 Enl	July 9, 1974	201.2 cfs

The dam and reservoir will be located in Sections 1 and 12, T33N, R72W; Section 36, T34N, R72W; Sections 31 and 32, T34N, R71W; and Sections 5, 6, 7, and 8, T33N, R71W. Locations of the appurtenant structures relative to the dam and reservoir are shown on Figures A-2 and A-3. The dam will have a crest length of about 6,100 feet, a maximum height of about 100 feet at the proposed crest elevation of 4970, and an embankment volume estimated at about 2,000,000 cubic yards.

In order to deliver surface water to Panhandle Reservoir No. 1, water from the North Platte River will enter a reentry channel and then be pumped through a 60" pipeline to the reservoir. The outlet works of the dam will be constructed

near the maximum section and will lead to a pumping plant which will pump water from the reservoir to the plant site. The pumping plant will also contain a booster pumping station for water coming from the Green Valley Well Field.

Spillways presently being considered for the dam are a concrete-lined service spillway near the right abutment and an unlined emergency spillway around the left abutment. The dam shown in Figure A-2 would be a zoned, earth embankment approximately 100 feet high constructed across Soldier Creek, with a crest width of approximately 15 feet and side slopes of 3:1. The proposed normal high water level would be at an elevation of 4960, ten feet below the crest elevation of 4970. A grout curtain would extend into the bedrock and be located at the base of a keyway near the center of the dam.

Water would be withdrawn from the North Platte River through a reentry channel. The channel would be trapezoidal in cross section as shown in Figure A-2. The channel would have a 30' bed with 1½:1 side slopes. The depth of water is expected to be approximately 8 feet. The channel would be approximately 500 feet in length and would terminate at the pumping plant. The pumping plant would house four pumps. Pumps presently being considered are two 200-HP pumps and two 2000-HP pumps. These pumps would cover a range of discharges from approximately one cfs to 220 cfs. Pump discharges would enter the manifold leading to the 60" pipeline to transport water to the reservoir.

Geotechnical investigations at the plant site were conducted by Woodward-Clyde Consultants in 1975. They presented their findings in a report entitled Geotechnical Services for Panhandle Dam No. 1 near Douglas, Wyoming. This report was prepared for Engineering Associates, Inc. and is dated October 17, 1975.

CHAPTER IV

PIPELINES

Pipelines will be used to transport water from the well fields and Panhandle Reservoir No. 1 to the plant site. The terminus of all pipelines will be a temporary water storage pond located within the project site. All overland pipelines will be below grade. A typical pipeline installation is shown in Figure A-4. The locations of the pipelines and the diameters of the pipelines are shown in Figures B-1 and B-2. The plan and profile of the pipeline from Panhandle Reservoir No. 1 to the plant site is shown in Figure A-3. The pipeline from Morton's Well Field to the plant site is shown in Figure A-4. The pipeline from Green Valley Well Field to its connection with the pipeline from Panhandle Reservoir No. 1 to the plant site is shown in Figure A-3. The pipeline diameters are also shown in these figures. In general, the pipelines conveying water to the plant site range from about 12" to 24" in diameter. The pipelines between the well head and the main collection line are 6 to 10 inches in diameter.

It is expected that construction easements will generally be 150' in width. Exceptions to this may exist where difficult terrain is encountered, and construction easements then might extend to 200'. After installation of the pipeline, any disturbed areas would be graded, scarified, and reseeded with natural vegetation for the area. No maintenance of the pipeline corridor is anticipated once the vegetation has reestablished itself.

Locations of pipelines crossing fences would be handled on an individual basis. Generally, gates would be installed that could be appropriately locked.

At low points in the pipeline, blowoff valves for drainage of the pipeline would be installed. At the high points of the pipelines, air and vacuum release valves would be installed and housed in manholes. At river crossings and stream

crossings the pipeline would be buried beneath the river bed and encased in concrete before backfilling the trench with the natural stream bed material.

The pipeline from the reservoir to the plant site is 39,400 feet in length. It contains two pumping plants located as shown in Figure A-1. Normal discharge in the pipeline will be 9 cfs. The pumping plant located near the Panhandle Reservoir No. 1 will contain a 650-HP pump. The second pumping plant, located approximately midway along the pipeline, will contain a 550-HP pump. The area contained within each pumping plant compound will be approximately 3-5 acres.

The pipeline from the collection terminus at the Morton's Well Field to the plant site will be 31,000 feet in length. The diameter of the pipe will be 14". Booster pumps may be required at some well sites to provide sufficient head to convey the water from the well site to the plant site. Locations of the collection pipelines in the Morton's Area are shown in Figure B-2.

The pipeline from the Green Valley Well Field collection terminus to the junction with the pipeline from Panhandle Reservoir No. 1 to the plant site is 73,600 feet in length. Pipe diameter is 18". The maximum discharge in this pipeline will be 9 cfs. The two major waterways that the pipeline will cross are LaPrele Creek and the North Platte River. The pumps at each well will be designed to provide sufficient head to convey the water from the well field to the reservoir pipeline junction with no additional pumping required. Locations of the collection pipelines in the Green Valley Area are shown in Figure B-1.

CHAPTER V

OPERATIONS STUDIES

Water yields from each of the water sources previously described are estimated from historical data and from proposed operations procedures. In order to determine the adequacy of the proposed water sources for the WyCoalGas Coal Gasification Project, a computer model was developed. The time period used in the simulations was 1930-1979. To determine the water available from the LaPrele Reservoir supply, a separate computer model provided input for the overall analysis. These two models will be incorporated into one model at a later time and refinements made as more detailed information is received, although the refinements are not expected to substantially change the results.

LaPrele Operation Study

The operation of LaPrele Reservoir relative to supplying water to the WyCoalGas Coal Gasification Plant is based on the agreement between the Douglas Reservoir Water Users Association and Panhandle Eastern Pipeline Company and is further regulated by the State Board of Control Order (refer to the Surface Water Supply section). For the operation study much of the criteria used was obtained from two U. S. Bureau of Reclamation reports on the LaPrele Unit dated November 1952, and May 1969. The LaPrele Reservoir inflow is assumed to be flows recorded immediately upstream of the reservoir at the USGS gaging station (#06-6490) plus 5.5% of the recorded flows to account for the remaining contributing watershed area between the gage and the reservoir (based on USBR reports). Seepage from the reservoir is estimated using a relationship of storage volume to seepage flow based on data collected since the rehabilitation of LaPrele Reservoir. All seepage is charged against the storage accounts. In the operation study, it is assumed that the full downstream senior rights of 1 cfs per 70 acres are

required. It is also assumed that during each irrigation season an average of 800 acre-feet of the senior rights demand is met by return flows (based on the 1962 USBR report). There are lands that have a senior priority to the LaPrele Unit (also referred to as Association lands) but are served by the LaPrele Unit canals. These are referred to as carrier rights. For purposes of the operation study, the carrier rights are treated the same as the LaPrele Unit lands (this was the assumption used by the USBR and probably represents actual operation of LaPrele). The average irrigation demand used for the Association lands plus the carrier rights is 3.26 acre-feet per acre per irrigation season. It is assumed that 5% of this demand is met by return flows from within the unit itself. A proposed release schedule to Panhandle Eastern was established based on the agreement with the Douglas Reservoir Water Users Association. The proposed release schedule and other pertinent data can be found in the following tables under Operation Studies Data and in Appendix C.

The reservoir inflow is determined by 105.5% of the flow at USGS gage #06-6490 as previously stated. During the nonirrigation season, all inflows are added to storage. If necessary, this water first goes to filling the dead pool depleted by seepage. Any additional storage is then released to meet Panhandle's scheduled release.

Panhandle's scheduled releases cannot be met every month. Deficient releases can occur because of insufficient inflow or storage. Excess releases can occur because of seepage that is greater than the scheduled release. Therefore, Panhandle's release each month is determined by accounting for these factors. An attempt is made each month to balance the accumulated year-to-date releases. All inflow is accounted for in storage or to meet direct flow rights. During the irrigation season, flows are first bypassed to meet senior priority downstream rights. If inflows exceed senior rights, flows are bypassed to meet the LaPrele Unit irrigation requirements (including carrier rights), which are limited to their

OPERATION STUDIES
DATA SHEET

Table A

Panhandle Eastern Plant Demand

Oct.	13.65 acre-feet/day
Nov.-Aug.	17.06 acre-feet/day
Sept.	13.65 acre-feet/day

Table B

Proposed Total LaPrele Release for Panhandle (Including Seepage)

	Monthly	Accumulative	
	(In Thousand Acre Feet)		
Oct.	0.37	0.37	
Nov.	0.35	0.72	
Dec.	0.36	1.08	Nonirrigation
Jan.	0.37	1.45	Season
Feb.	0.33	1.78	
Mar.	0.37	2.15	
Apr.	0.35	2.50	
May	0.93	3.43	
June	0.90	4.33	
July	0.23	4.56	Irrigation
Aug.	0.22	4.78	Season
Sep.	0.22	5.00	

Table C

Evaporation Rates (Panhandle Reservoir #1 and LaPrele Reservoir)

Month	Ft./Surface Area	Month	Ft./Surface Area
Oct.	0.17	Apr.	0.24
Nov.	0.10	May	0.32
Dec.	0.09	June	0.36
Jan.	0.09	July	0.44
Feb.	0.08	Aug.	0.40
Mar.	0.14	Sep.	0.26

Table D

LaPrele Reservoir

Senior Downstream Rights (153-day irrigation season)

1469 acres ≈ 41.61 acre-feet/day
Return flows = 5.23 acre-feet/day (800 acre-feet/season)
Net senior rights demand = 36.38 acre-feet/day

Association Demand (including carrier rights)

Association lands	10,304.5 acres
Carrier rights	1,149.5 acres
Total lands	11,454.0 acres
Direct flow right	324.55 acre-feet/day
Demand per season	(3.26 acre-feet/acre less 5% demand met by return flows) 35,473 acre-feet

May	June	July	August	September
4,611	8,868	11,351	7,449	3,194

Table E

Seepage from LaPrele

Capacity (Acre-Feet)	Seepage (Acre-Feet/Day)
0	0
250	0
416	1.67
961	3.47
1,600	4.76
2,000	5.40
4,000	7.48
8,000	11.62
12,000	15.79
16,000	19.93
20,000	24.08

Table F

LaPrele Reservoir Capacity

Contour	Capacity (A.F.)	Contour	Capacity (A.F.)
5401.6	152	5446	3082
5402	157	5447	3269
5403	171	5448	3456
5404	184	5449	3644
5405	198	5450	3831
5406	216	5451	4057
5407	234	5452	4284
5408	252	5453	4510
5409	271	5454	4736
5410	289	5455	4963
5411	314	5456	5231
5412	340	5457	5500
5413	365	5458	5769
5414	391	5459	6038
5415	416	5460	6306
5416	451	5461	6619
5417	485	5462	6932
5418	520	5463	7244
5419	554	5464	7557
5420	589	5465	7870
5421	637	5466	8227
5422	685	5467	8584
5423	733	5468	8941
5424	781	5469	9298
5425	830	5470	9655
5426	895	5471	10060
5427	961	5472	10465
5428	1027	5473	10870
5429	1093	5474	11275
5430	1158	5475	11681
5431	1244	5476	12143
5432	1330	5477	12605
5433	1415	5478	13067
5434	1501	5479	13529
5435	1587	5480	13991
5436	1700	5481	14514
5437	1813	5482	15037
5438	1925	5483	15561
5439	2039	5484	16084
5440	2151	5485	16607
5441	2300	5486	17194
5442	2448	5487	17781
5443	2597	5488	18368
5444	2746	5489	18955
5445	2894	*5490	19542

*Crest of Spillway

direct flow rights. If any excess flows remain, the flows are then placed in storage in LaPrele Reservoir. Any deficits to the Association, after direct flow bypasses are made, are then released from storage along with the intentional Panhandle release and the seepage. In the event storage does not meet both Panhandle and the Association demands, 25% of the available storage, limited to Panhandle's maximum monthly scheduled release, is released to Panhandle Eastern and the remainder is released to the Association.

The reservoir is operated under the one-fill limitation on storage with all Panhandle releases (including seepage), irrigation storage releases, and evaporation losses being charged against the one-fill account. Spills are made when the one-fill account has been exceeded or when the physical capacity of the reservoir is exceeded. Evaporation losses are calculated based on the average surface area of the reservoir during that month.

Panhandle Eastern Water Supply Operation Study

The purpose of the operations study is to determine the requirements and interaction of the proposed water sources. Results of the LaPrele Reservoir operation study just described are one of the major water source inputs to the overall operations study. Another major water source input is the "Owed-To-the-River" water in the North Platte River system. These O.T.R. water quantities were obtained from the WRRI study entitled "North Platte River Operational Study". This study and its accompanying report were first published in June 1977, under a contract for the USBR. The operational study is presently being revised by WRRI under a joint contract involving Panhandle Eastern, the Wyoming State Engineer's Office, and the Water and Power Resources Service (formerly USBR).

In the Panhandle Eastern Water Supply Operation Study, a 10% conveyance loss was used from LaPrele Dam to Panhandle's point of diversion on the North Platte River. For the North Platte supply it is assumed that 6,000 acre-feet

of O.T.R. water are available in any month before Panhandle can divert any O.T.R. water. The upper limit of the amount available to Panhandle is their 1974 Priority right of 201.2 cfs or approximately 12,000 acre-feet in any month. The North Platte right also limits the total volume of water that can be stored in Panhandle Reservoir No. 1 under the one-fill criteria. Due to the one-fill limitation of water entering Panhandle Reservoir No. 1, separate accounting of each water source in the reservoir is required. As each water source reaches the diversion point, a "check" of the quantities is compared to pipeline capacity, remaining plant demand, one-fill limitations, and Panhandle Reservoir No. 1 physical capacity. If any limitation exists, that portion exceeding the limitation(s) is bypassed rather than diverted. The plant demand is met based on the following priorities:

1. LaPrele supply diverted directly to the plant
2. 1974 Priority North Platte water diverted directly to the plant
3. Storage releases from Panhandle Reservoir No. 1
    A. LaPrele Account
    B. North Platte Account

It is assumed that if a plant demand exists after all storage in Panhandle Reservoir No. 1 is depleted, the deficit is met by groundwater. The groundwater is delivered first from the Green Valley Well Field and then the Morton's Well Field. A volume limit of 2,000 acre-feet per year of groundwater is imposed in this study on the Green Valley groundwater source and is supplied entirely before water is pumped from the Morton's well field. The Morton's well field will supply the remainder of the groundwater. A volume limit of 2,000 acre-feet per year of groundwater is imposed on the Morton's well field for the study also. Based upon the results of the operations study, the Morton's well field needed to supply a maximum of 680 acre-feet of water per year. Upon analysis of the operation study, the imposed groundwater demand appears to be a reasonable amount

that could be expected from the two well fields. All groundwater would be supplied directly to the plant and would not be placed in Panhandle Reservoir No. 1.

Evaporation losses in Panhandle Reservoir No. 1 were based on the average surface area during the month and charged against the water accounts proportionately to the stored volume.

Copies of the LaPrele Operation Study and the Panhandle Eastern Water Supply Operation Study can be found in Appendix C. A narrative of the results can be found in the Surface Water Supply section. The following section summarizes the water requirements.

Summary

In the Panhandle Eastern Water Supply Operation Study, three sources of water are considered to meet the coal gasification plant demand of 6,020 acre-feet/year. The LaPrele supply yields an average of 4,150 acre-feet/year at the point of diversion. The 1974 Direct Flow Right from the North Platte River yields an average of 3,600 acre-feet per year. In most years, these two surface water supplies, together with utilizing storage capabilities in Panhandle Reservoir No. 1, are adequate to meet Panhandle Eastern's water needs. In years when the surface water sources are inadequate, groundwater from the Green Valley and the Morton's Well Fields will meet the deficit. In a 50-year study period of 1930-1979, groundwater is required in only 5 years with a maximum groundwater requirement of 2,700 acre-feet in one year. Groundwater would be required in only three consecutive years.

CHAPTER VI

CONSTRUCTION ESTIMATE

Listed below are the approximate land areas for various items that will be involved during construction. These values are based on the information that is available to date.

Construction of the reservoir pipelines and pumping plants will necessitate land disturbance during construction. Ditches will be excavated along all pipeline routes, and these will be filled in after the pipe is placed. No permanent roads along the pipeline routes are presently planned. All pipeline routes will be graded, dressed, and reseeded with a natural vegetation seed mixture.

Pumping plant sites and well locations will require level construction areas. All-weather paved or gravel-surfaced roads will connect the sites to existing county or state roads.

The reservoir and dam areas will be cleared of all trees. Portions of the reservoir will be excavated to provide material for the embankment. Riprap will be hauled from sites west of Douglas or from a quarry near Guernsey.

Roads will be improved and constructed to provide all weather access to the major features of the water supply system. Permanent access will be required to Panhandle Reservoir No. 1 and its appurtenant structures, to the wells, to the pumping plants on the pipeline and on the reentry channel. Temporary roads will be required during construction following pipeline routes and leading to borrow areas and other sites. The roads will connect to the existing county and state road systems. Some of the preliminary routes for permanent roads are shown on the vicinity maps in Appendices A and B. Roads required for construction are not shown. All roads are subject to relocation during the final stages of design.

Approximately 28 miles of new and improved roads could be constructed in support of the water supply system construction: about 3 miles in the vicinity of the reservoir; about 9 miles in the Green Valley Well Field; and about 16 miles in the Morton's Well Field.

The following table summarizes the approximate land areas disturbed during construction; the land area required for operation after construction; the projected useful life of the facility assuming proper operation and maintenance; the tentative construction schedule; construction procedures; fuel consumption; construction work force; and estimated total construction costs.

1. Land Disturbance during Construction

	Acres
A. Pipelines	
Morton's to Plant Site	110
Morton's Collection System	320
Green Valley to Pumping Station	254
Green Valley Collection System	158
Pumping Station to Reservoir	10
Pumping Station to Plant Site	136
B. Panhandle Reservoir #1	1,000
C. Roads	300
Total	2,288

2. Land Required for Operation after Construction

	Acres
A. Pipeline	
Morton's to Plant Site	37
Morton's Collection System	107
Green Valley to Pumping Station	85
Green Valley Collection System	53

	Acres
Pumping Station to Reservoir	4
Pumping Station to Plant Site	45
B. Panhandle Reservoir #1	50
C. Roads	200
Total	581

3. Projected Life

A. Pipelines and Pumping Stations

It is anticipated that the projected useful lifetime for this type of facility will be 50 years.

B. Panhandle Reservoir #1

It is anticipated that the projected lifetime for this type of structure is approximately 100 years with proper operation and maintenance.

4. Construction Schedule

A. Pipelines

April year 1 through July year 2.

B. Panhandle Reservoir

April year 1 through August year 2.

For a detailed breakdown see Appendix D of this report.

5. Construction Procedures - Equipment List (Major Items)

A. Panhandle Reservoir #1

Item	Number
1. Concrete Batch Plant	1
2. Screening Plant	1
3. Cranes	4
4. Trucks	18
5. Light Plants	10
6. Scrapers	20

Item	Number
7. Push Cats	2
8. Dozers with Ripper	4
9. Compacters	3
10. Industrial Disc	2
11. Waterwagons	2
12. Patrols	3
13. Backhoe	1
14. Dragline	1
15. Loaders	4
16. Drilling Rig	2
17. Grout Pump	2
18. Concrete Pump	1

B. Pipelines (Equipment Required per Pipeline Crew)

Item	Number
1. Backhoe	2
2. Loaders	2
3. Patrol	1
4. Dozer with Ripper	1
5. Trucks	8
6. Crane	1
7. Compaction Equipment	1
8. Pumps	4
9. Boring Equipment	1
10. Farm Tractor and Spreader	1

6. Estimated Construction Fuel

A. Pipeline

Approximately 1,000 gallons of fuel will be used on a daily basis.

B. Panhandle Reservoir #1

On an average, 7,000 to 10,000 gallons of fuel will be used per day unless the embankment is being placed and then up to 25,000 gallons per day may be used.

7. Construction Work Force

A. Pipeline

The estimated construction work force for the pipelines will vary from 4 to 161 with a maximum work force of 161 in August of year 1.

B. Panhandle Reservoir #1

The estimated construction work force for the dam, reentry channel, and pumping station will vary from 25 to 247 with a maximum work force of 247 in May of year 2.

For a detailed breakdown of the above work forces, see Appendix D of this report. In Appendix D the various number of crafts and trades are shown on a monthly basis. The estimate of manpower is based upon the information available at this time.

The present (1981) wage rate of the various crafts and trades is included in Appendix D.

There could be enough manpower in the Douglas-Casper area to provide the work force required. However, with all the construction going on at the plant site, it may be necessary to have up to 50% of the work force brought in from outside the local area.

8. Estimated Total Construction Cost

A. Pipelines

Morton's to Plant Site	$1,440,000
Green Valley to Pumping Station	4,350,000
Pumping Station to Reservoir	4,100,000
Pumping Station to Plant Site	6,100,000

Morton's Collection System	2,400,000
Green Valley Collection System	1,160,000
B. Panhandle Reservoir #1	21,000,000
C. Roads	5,100,000
Total	$45,650,000

PRELIMINARY TECHNICAL DATA REPORT

WYCOALGAS PROJECT WATER SYSTEM

Appendices A, B, and D

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JANUARY 1981

APPENDIX A

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FIG. A-1
Water System Area Map
(In Folder)

FIG. A-2
Panhandle Reservoir No. 1 Area Map & Details
(In Folder)

FIG. A-3
Pipeline Profiles

FIG. A-4
Pipeline Profiles

APPENDIX B

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FIG. B-1
Water System Green Valley Area
(In Folder)

FIG. B-2
Water System Mortons Area
(In Folder)

APPENDIX D

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TENTATIVE CONSTRUCTION SCHEDULE

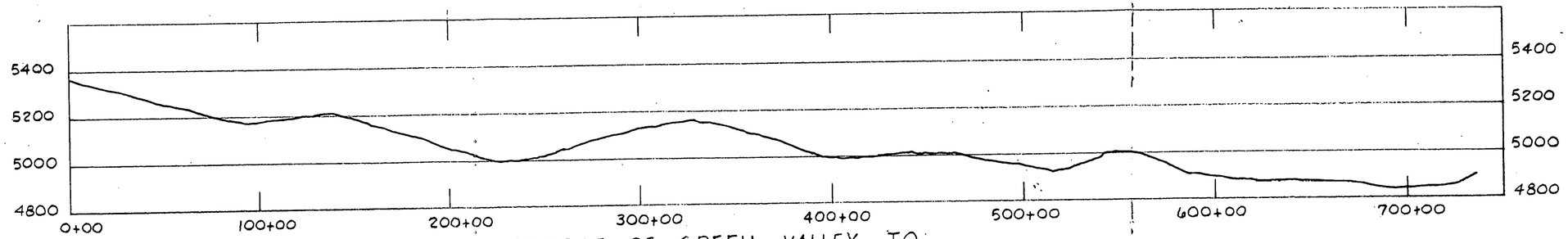
Panhandle Reservoir No. 1	2 Sheets
Groundwater	1 Sheet
Pipelines	6 Sheets

TENTATIVE NUMBER OF CONSTRUCTION PERSONNEL

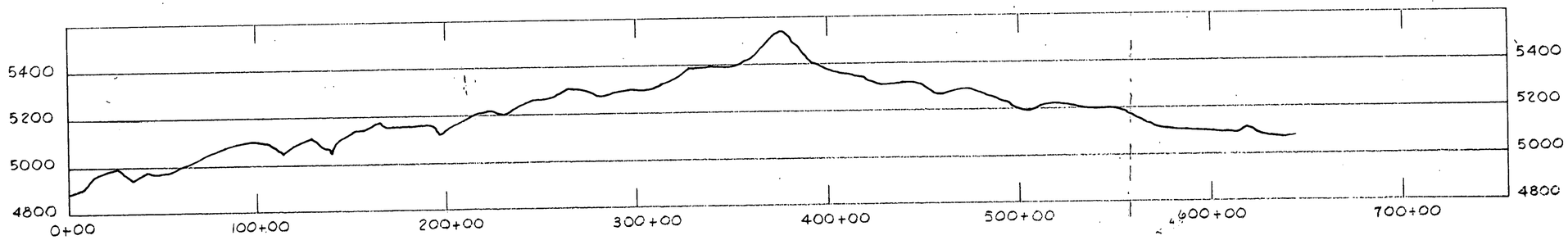
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Groundwater	1 Sheet
Pipelines	1 Sheet

PREVAILING WAGE RATES 2 Sheets

3



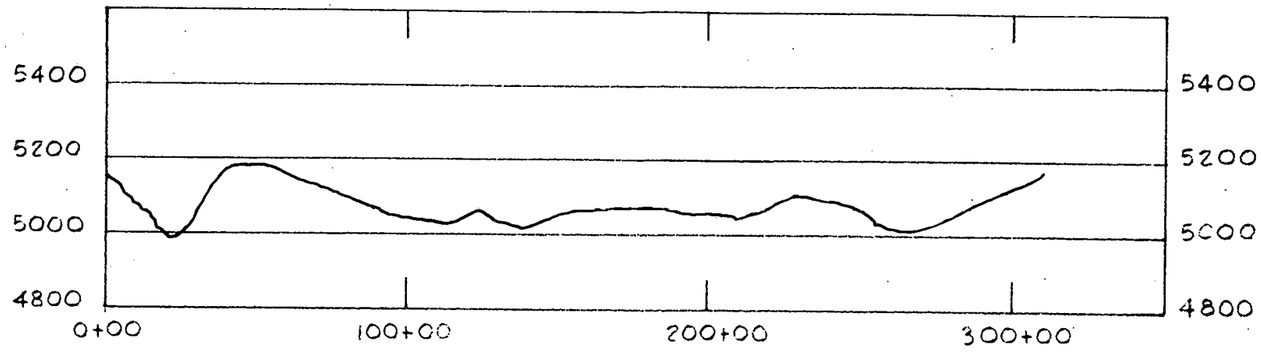
PROFILE OF GREEN VALLEY TO
PANHANDLE RESERVOIR NO. 1 PIPELINE
HORIZONTAL SCALE: 1"= 5,000'
VERTICAL SCALE: 1" = 200'



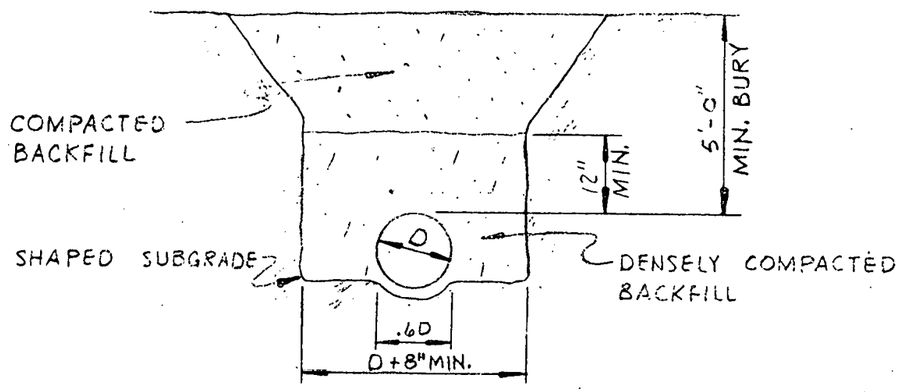
PANHANDLE RESERVOIR NO. 1
TO PLANT SITE PIPELINE
HORIZONTAL SCALE: 1"= 5,000'
VERTICAL SCALE: 1" = 200'

PIPELINE PROFILES

FIG. A-3



MORTONS AREA
TO PLANT SITE PIPELINE
HORIZONTAL SCALE: 1"= 5,000'
VERTICAL SCALE: 1"= 200'



TYPICAL PIPE BEDDING DETAIL
NO SCALE

PIPELINE · PROFILES

FIG. A-4

TENTATIVE CONSTRUCTION SCHEDULE

PANHANDLE RESERVOIR NO. 1

WORK ITEM	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
1. Mobilize																	
2. Clear & Grub Dam & Abutments																	
3. Excavation of Keyway																	
4. Foundation Preparation																	
5. River Diversion																	
6. Drill & Grout																	
7. Borrow Area Preparation																	
8. Screening Plant Set up & Production																	
9. Excavation of Outlet Works																	
10. Excavation of ReEntry & Pump Station																	
11. Excavation of Spillways																	
Service																	
Emergency																	
12. Concrete Batch Plant Set up & Operation																	
13. Construction of Outlet Works																	
14. Construction of Pump Station																	

2

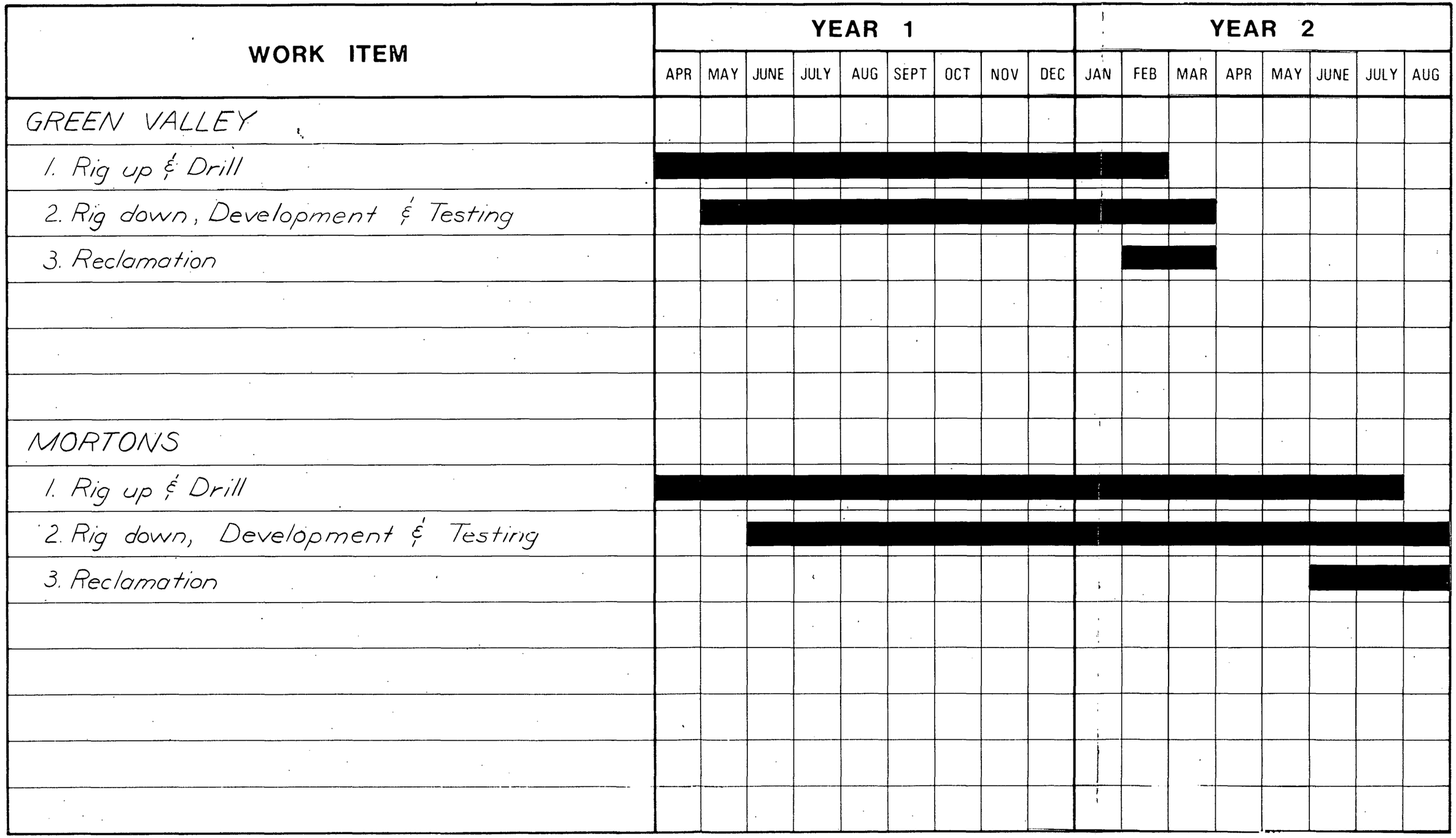
TENTATIVE CONSTRUCTION SCHEDULE

PANHANDLE RESERVOIR NO. 1

WORK ITEM	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
15. Construction of Service Spillway												■	■	■	■		
16. Construction of Embankment				■	■	■	■	■			■	■	■	■	■	■	■
17. Riprap & Bedding																	
Production								■	■	■	■						
Installation												■	■	■	■	■	■
18. Filter Drain				■	■	■	■					■	■	■	■	■	
19. Start up & Testing																■	
20. Reclamation of Area																■	■
21. Demobilize																	

TENTATIVE CONSTRUCTION SCHEDULE

GROUNDWATER



2

TENTATIVE CONSTRUCTION SCHEDULE

PIPELINES

WORK ITEM	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
1. Pumping Plant to Reservoir																	
A - Mobilize																	
B - Order Pipe																	
C - Right of Way Preparation																	
D - Fence Work																	
E - Trench Excavation																	
F - Deliver Pipe																	
G - Laying Pipe																	
H - Backfilling Pipe																	
I - Reclamation of Area																	
J - Test																	
K - Demobilize																	
2. Reservoir to Plant Site																	
A - Mobilize																	
B - Order Pipe																	

V

TENTATIVE CONSTRUCTION SCHEDULE

PIPELINES

WORK ITEM	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
C - Right of Way Preparation																	
D - Fence Work																	
E - Trench Excavation																	
F - Deliver Pipe																	
G - Highway Crossing																	
H - Lay Pipe																	
I - Backfill Pipe																	
J - Structures																	
Pumping Plants (2)																	
K - Reclamation of Area																	
L - Testing																	
M - Demobilize																	
3. Morton's Ground Water to Plant Site																	
A - Mobilize																	
B - Order Pipe																	

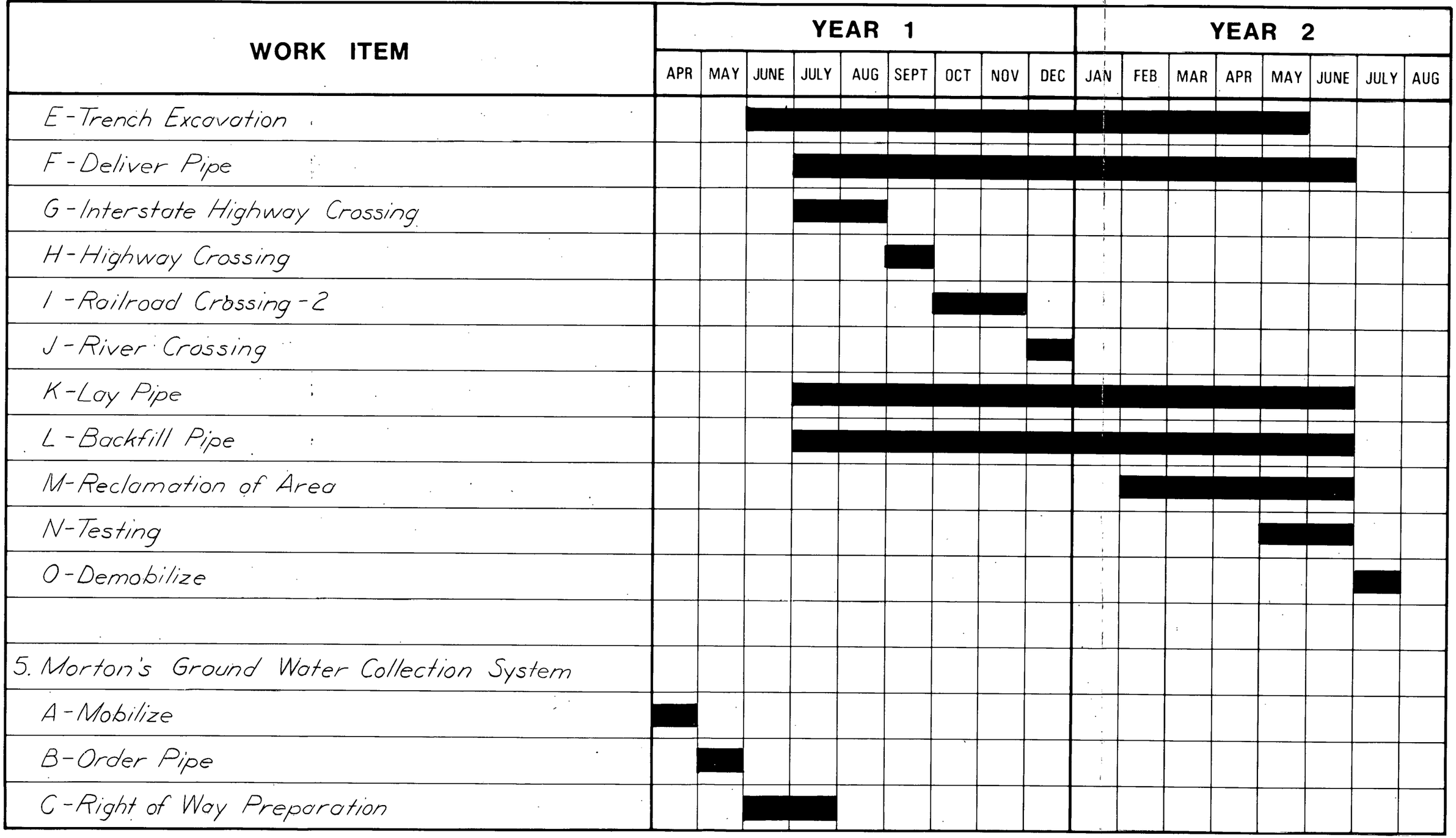
TENTATIVE CONSTRUCTION SCHEDULE

PIPELINES

WORK ITEM	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
C - Right of Way Preparation																	
D - Fence Work																	
E - Trench Excavation																	
F - Deliver Pipe																	
G - Highway Crossing																	
H - Lay Pipe																	
I - Backfill																	
J - Reclamation of Area																	
K - Testing																	
L - Demobilize																	
4. Green Valley to Pump Station																	
A - Mobilize																	
B - Order Pipe																	
C - Right of Way Preparation																	
D - Fence Work																	

TENTATIVE CONSTRUCTION SCHEDULE

PIPELINES



TENTATIVE CONSTRUCTION SCHEDULE

PIPELINES

WORK ITEM	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
D - Fence Work																	
E - Trench Excavation																	
F - Deliver Pipe																	
G - Lay Pipe																	
H - Backfill Pipe																	
I - Reclamation of Area																	
J - Testing																	
K - Demobilize																	
6. Green Valley Ground Water Collection System																	
A - Mobilize																	
B - Order Pipe																	
C - Right of Way Preparation																	
D - Fence Work																	
E - Trench Excavation																	
F - Deliver Pipe																	

TENTATIVE CONSTRUCTION SCHEDULE

PIPELINES

WORK ITEM	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
G - Lay Pipe					■	■											
H - Backfill Pipe					■	■											
I - Reclamation of Area							■										
J - Testing								■									
K - Demobilize									■								

V

TENTATIVE NUMBER OF CONSTRUCTION PERSONNEL

PANHANDLE RESERVOIR NO. 1

JOB CLASSIFICATION	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
Project Manager	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Construction Engineers & Office Staff	3	5	7	13	13	13	13	13	13	13	13	13	13	10	9	7	5
Supervision	5	8	12	16	21	21	21	21	16	16	21	21	21	21	21	21	16
Carpenters	4	4	4	1	1	1	10	10	10	10	20	20	20	20	20	1	1
Electricians	2	2	1	1	1	2	2	2	2	2	2	4	4	4	4	2	2
Iron Workers	2	2			2	2	4	4	4	4	8	8	8	8	8	4	2
Laborers	4	5	10	12	20	20	25	25	25	20	25	30	30	30	25	20	10
Operating Engineers	2	6	14	103	129	131	133	89	32	18	71	115	115	115	115	116	109
Painters										2	2			2	2	2	2
Plumbers & Pipefitters										3	3	3	3	3	3	2	2
Teamsters	2	4	7	20	30	30	30	20	20	20	30	30	30	30	30	20	10
TOTAL	25	37	56	167	218	221	239	185	123	109	196	245	245	244	238	196	160

V

TENTATIVE NUMBER OF CONSTRUCTION PERSONNEL

GROUNDWATER

JOB CLASSIFICATION	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
Project Manager	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Construction Engineer & Office Staff	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Driller	4	5	5	6	6	6	6	6	6	6	6	4	3	3	3	3	1
Driller Helper	8	11	14	14	14	14	14	14	14	14	14	10	7	7	7	7	3
Laborers	8	12	16	16	16	16	16	16	16	16	20	14	8	8	12	12	8
TOTAL	24	32	39	40	40	40	40	40	40	40	44	32	22	22	26	26	16

TENTATIVE NUMBER OF CONSTRUCTION PERSONNEL

PIPELINES

JOB CLASSIFICATION	YEAR 1									YEAR 2							
	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
Project Manager	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Construction Engineer & Office Staff	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3
Supervision			3	7	11	9	8	7	4	3	2	2	2	2	1		
Carpenters				8	14	12	12	8	6	4	2	2	2	2	2		
Iron Workers				8	12	14	12	8	6	4	2	2	2	2	2		
Laborers		5	19	44	46	43	34	31	20	17	15	16	12	12	10		
Operating Engineers		8	22	44	46	44	36	38	24	24	16	18	14	14	10		
Teamsters				15	25	30	20	20	15	10	5	5	5	5	5		
TOTAL	4	20	51	133	161	159	129	119	82	69	49	52	44	44	37	4	4

PREVAILING WAGE RATES

Craft	Base Wage	H & W	Pens.	Appr.	Vac.
Boilermakers	12.87	1.275	1.00	.05	
Bricklayers	11.60		.30	.05	
Carpenters	10.82	.70	.65	.17	.75
Carpet, Lineoleum, & Soft Tile Layers	11.18	.65	.75	.10	.50
Cement Masons	11.20	.55		.05	
Electricians	11.45	.72	3%+.25	3/4%	
Electricians - Linemen	11.00	.45	3%+.50	.4%	
Elevator Constructors	12.52	1.045	.69	.03	8%
Glaziers	8.65				6%
Sheetmetal Workers	11.03	.58	.54	.10	1.25
Teamsters					
Pickup Truck Driver	9.47	.55	.61		
Dump Trucks - Water Level Capacity					
Dump to 6 cu. yds.	9.57	.55	.61		
Dump 6 to 13 cu. yds.	9.67	.55	.61		
Dump 13 to 20 cu. yds.	9.82	.55	.61		
Dump 20 to 30 cu. yds.	10.02	.55	.61		
Dump 30 cu. yds. & over	10.17	.55	.61		
Flat Rack	9.57	.55	.61		
Flat Rack - Semi (Single Axle)	9.67	.55	.61		
Dumpster Type Equipment Youngbuddy, Similar	9.92	.55	.61		
Fork Lift Operator	9.72	.55	.61		
Cement Mixer (Under 10 yds.)	9.82	.55	.61		
Highboy, Loboy, Floats, Semi (Tandem Axle)	9.87	.55	.61		
Winch Pole - A Frame	9.87	.55	.61		
Flex Boom Operator (Single Axle)	9.87	.55	.61		
Flex Boom Operator (Twin Screw)	9.97	.55	.61		
Fuel Truck - Grease Truck - Truck Equipment	9.77	.55	.61		
Water Truck (Single Axle)	9.57	.55	.61		
Water Truck (Semi or Tandem Axle)	9.82	.55	.61		
Expediter	9.67	.55	.61		
Truck Driver Helpers	9.52	.55	.61		
Truck Mechanics	9.97	.55	.61		
Ironworkers (Structural & Reinforcing)	12.05	.75	1.35	.15	
Laborers					
Group I	7.94	.41	.40	.05	1.00
Group II	8.19	.41	.40	.05	1.00
Groups III & IV	8.39	.41	.40	.05	1.00
Group V	8.40	.41	.40	.05	1.00
Group VI	8.34	.41	.40	.05	1.00
Group VII	8.24	.41	.40	.05	1.00
Group VIII	8.09	.41	.40	.05	1.00
Group IX	8.84	.41	.40	.05	1.00

Craft	Base Wage	H & W	Pens.	Appr.	Vac.
Millwrights	11.51	.90	.85	.135	
Operating Engineers					
Group I	10.50	.65	.65	.10	1.00
Group II	10.84	.65	.65	.10	1.00
Group III	11.19	.65	.65	.10	1.00
Group IV	11.36	.65	.65	.10	1.00
Group V	11.74	.65	.65	.10	1.00
Group VI	12.67	.65	.65	.10	1.00
Group VII	13.01	.65	.65	.10	1.00
Painters	7.05				
Plumbers & Pipefitters	10.97	.80	.75	.18	1.50
Plasterers	11.43	.50		.01	.10
Roofers	10.15				1.70

R. 75 W. R. 74 W.

R. 74 W. R. 73 W.

R. 73 W. R. 72 W.

R. 72 W. R. 71 W.

R. 71 W. R. 70 W.

T. 36 N.

T. 35 N.

T. 34 N.

T. 33 N.

T. 32 N.

T. 31 N.

N

FEET 4000 0 4000 8000 12,000 FEET

SCALE

SHUTTLE RAILROAD

WELL FIELD COLLECTION POINT

WYCOALGAS COAL GASIFICATION PLANT SITE

MORTONS AREA TO PLANT SITE PIPELINE

RAW WATER TREATMENT FACILITY

NEW ROAD

APPROXIMATE MORTONS AREA LEASE BOUNDARY

PUMP STATION
1-550 H.P. PUMP

PANHANDLE RESERVOIR NO. 1

DAM ACCESS ROAD

PANHANDLE RESERVOIR NO. 1 TO PLANT SITE PIPELINE

NORTH PLATTE RIVER TO PANHANDLE RESERVOIR NO. 1 PIPELINE

NORTH PLATTE RIVER

PUMP STATION
1-250 H.P. PUMP

PUMP STATION
2-2000 H.P. PUMPS
2-200 H.P. PUMPS

RE-ENTRY CHANNEL

GREEN VALLEY TO PANHANDLE RESERVOIR NO. 1 PIPELINE

APPROXIMATE GREEN VALLEY AREA LEASE BOUNDARY

REVISED PIPELINE LOCATION

WELL FIELD COLLECTION POINT

LA PRELE RESERVOIR

Douglas

APRIL, 1981

16 △ DENOTES WYCOALGAS PROJECT ACTIVITY WHICH AFFECT WATERS OF THE UNITED STATES

REV.	DATE	DESCRIPTION	BY	APPR.
1	3/25/81	REVISED GREEN VALLEY COLLECTOR TO AVOID APPARENT ALKALINITY	TLV	MKP

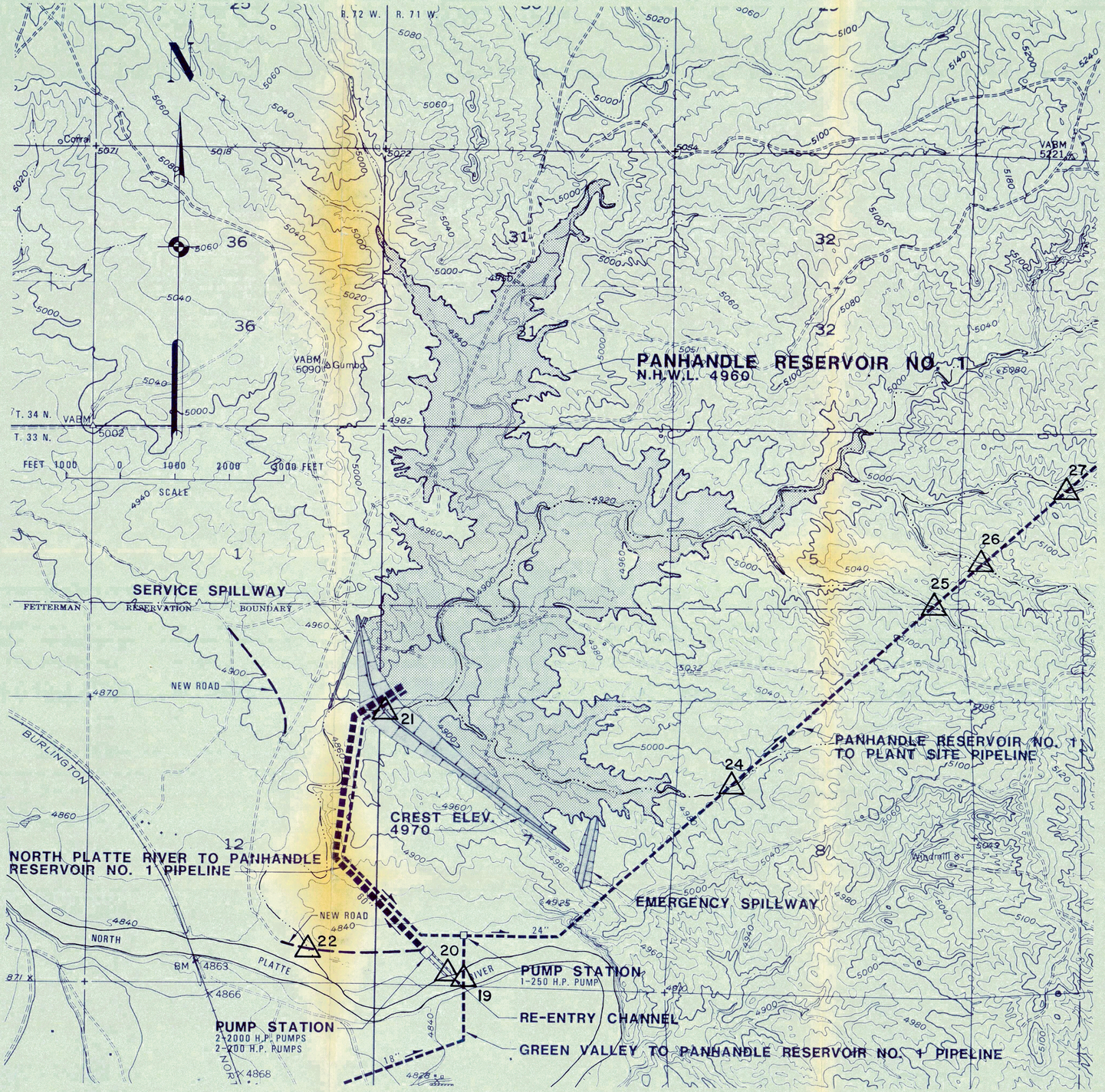
NOTE: SUBJECT TO FINAL DESIGN CHANGES

WYCOALGAS PROJECT WATER SYSTEM

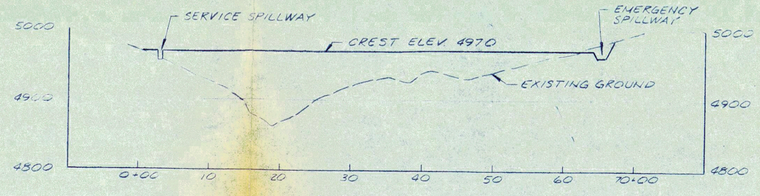
AREA MAP

PREPARED BY
BANNER ASSOCIATES, INC.
CONSULTING ENGINEERS
JANUARY, 1981

FIG. A-1

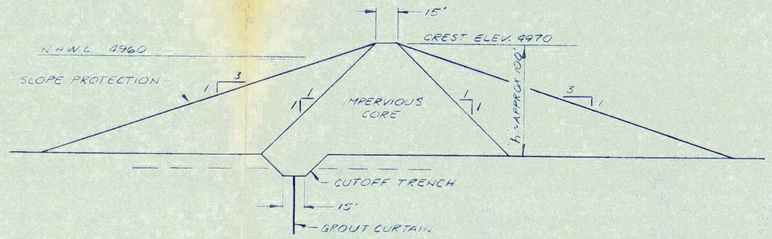


RESERVOIR AREA MAP



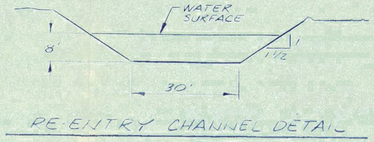
E PROFILE

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=100'



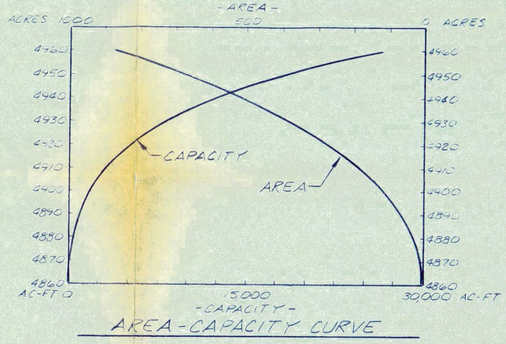
MAXIMUM SECTION

SCALE: 1"=50'



RE-ENTRY CHANNEL DETAIL

SCALE: 1"=20'



AREA-CAPACITY CURVE

APRIL, 1981

16 △

DENOTES WYCOALGAS PROJECT ACTIVITY WHICH AFFECT WATERS OF THE UNITED STATES.

NOTE: ALL SUBJECT TO FINAL DESIGN CHANGES

PREPARED BY:

BANNER ASSOCIATES, INC.

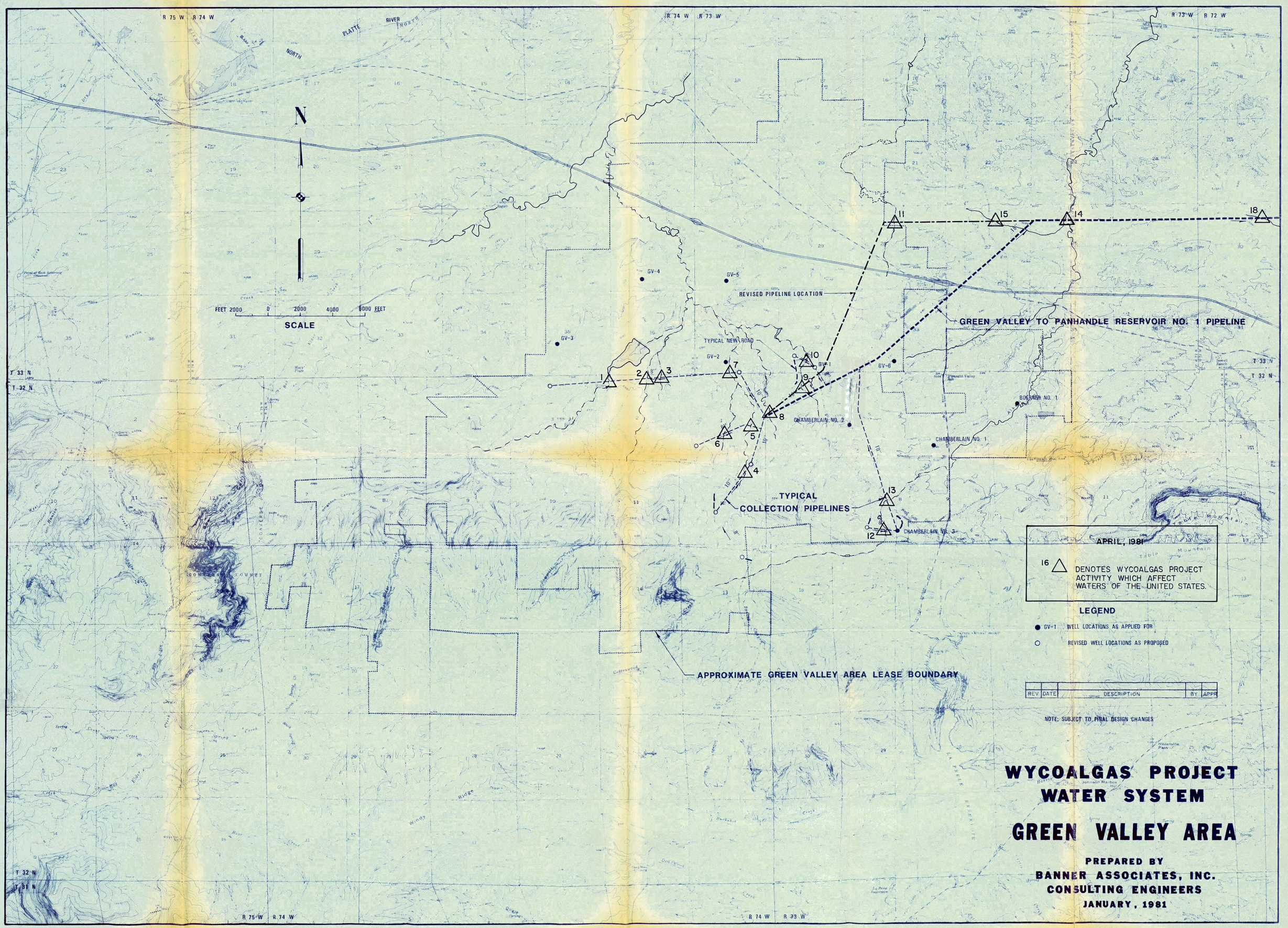
CONSULTING ENGINEERS

WYCOALGAS PROJECT

PANHANDLE RESERVOIR NO. 1

AREA MAP AND DETAILS

JANUARY, 1981



WYCOALGAS PROJECT
WATER SYSTEM
GREEN VALLEY AREA

PREPARED BY
BANNER ASSOCIATES, INC.
CONSULTING ENGINEERS
JANUARY, 1981

FIG. B-1

R. 71 W. R. 70 W.

T. 36 N.
T. 35 N.
T. 34 N.
T. 33 N.

Box Creek Ranch
Fink Ranch
BM 5176 △ Fridley
Bowman Draw
Spring
Mines
PRIVATE
HIGHLAND LOOP ROAD
Lightning Draw
Little Lightning Creek
Gravel Pit
Artesian Well
Claasen School
Claasen Ranch
Windmill
Robinson Ranch
Combs Ranch
Walker Creek
Soldier Creek
Harvey Gulch
Trib

SHUTTLE RAILROAD

N

FEET 2000 0 2000 4000 6000 FEET
SCALE

TYPICAL COLLECTION PIPELINE

MORTONS NO. 1-23
MORTONS NO. 2
MORTONS NO. 3
MORTONS NO. 4
MORTONS NO. 5
MORTONS NO. 6
MORTONS NO. 7
MORTONS NO. 8
MORTONS NO. 9
MORTONS NO. 10
MORTONS NO. 11
MORTONS NO. 12
MORTONS NO. 13
MORTONS NO. 14
MORTONS NO. 15
MORTONS NO. 16
MORTONS NO. 17
MORTONS NO. 18
MORTONS NO. 20
L-FH NO. 1
L-FH NO. 2

TYPICAL NEW ROAD

MORTONS AREA TO PLANT SITE PIPELINE

WYCOALGAS PROJECT
COAL GASIFICATION PLANT SITE

RAW WATER TREATMENT FACILITY

PROPOSED PLANT SITE BOUNDARY

APPROXIMATE MORTONS AREA LEASE BOUNDARY

PUMP STATION
1-550 H.P. PUMP

PANHANDLE NO. 1 RESERVOIR TO PLANT SITE PIPELINE

APRIL, 1981

16 △ DENOTES WYCOALGAS PROJECT ACTIVITY WHICH AFFECT WATERS OF THE UNITED STATES.

REV.	DATE	DESCRIPTION	BY	APPR
1	3/23/81	INCLUDE LFH NOS 1 & 2 COLLECTOR	TLV	MKP

NOTE: SUBJECT TO FINAL DESIGN CHANGES

WYCOALGAS PROJECT
WATER SYSTEM
MORTONS AREA

PREPARED BY
BANNER ASSOCIATES, INC.
CONSULTING ENGINEERS
JANUARY, 1981

FIG. B-2